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The first species of *Parelcana* and the second species of *Longioculus* (Orthoptera, Elcanidae) from mid-Cretaceous Burmese amber

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Abstract

A new species of *Parelcana* Handlirsch, 1906, *Parelcana xena* **sp. nov.**, is described from mid-Cretaceous Burmese amber. The specimen consists of a well-preserved wing apparatus and parts of the thorax including pro- and mesothoracic legs. It stands out by its unusual morphology of the tegminal CuA + CuPaα fused to MP, which is suggested to be caused by individual variation. Additionally, the second species of the genus *Longioculus* Poinar, Gorochov & Buckley, 2007 is reported. *Longioculus burmensis* Poinar, Gorochov & Buckley, 2007 was the first Elcanidae Handlirsch, 1906 to be described from Burmese amber and pioneer of the many that were to follow. The new species *Longioculus poinari* **sp. nov.** is a female specimen in very good condition. Based on the new specimen's free 1A, CuPb, and CuPaβ, the genus *Longioculus* is assigned to the subfamily Archelcaninae Gorochov, Jarzembowski & Coram, 2006. The metatibial spurs of the new species *L. poinari*, which are not preserved in the holotype of *L. burmensis*, are leaf-like. *Longioculus poinari* differs from *L. burmensis* in some aspects of the metatibial armature. The new species increases the diversity of Burmese amber Elcanidae, raising their total species to 23.

Keywords

Archelcaninae, Burmese, fossil, individual variation, taxonomy

Introduction

Elcanidae Handlirsch, 1906 is an extinct family of Orthoptera Olivier, 1789 that appears in the fossil record throughout the Mesozoic and on all continents except Africa and Antarctica (e.g., Tillyard 1918, Zessin 1987, Martins-Neto 1991, Fang et al. 2018, Gu et al. 2020). They are characterized by a large dark area near the anterior margin of the forewing (pterostigma) and an overall appearance similar to many extant Ensifera Chopard, 1921 (i.e., antennae longer than body and ovipositor very prominent, often shaped like the blade of a scythe or sword). Apomorphy of the family are three pairs of large moveable spurs on the dorsal side of the metatibiae that vary in shape and are either leaf-like, ensiform, spine-like, or paddle-shaped (e.g. Peñalver and Grimaldi 2010, Heads et al. 2018, Kočárek 2020, Hu and He 2023).

A plethora of Elcanidae species have been found since 2007 in Burmese amber from Northern Myanmar (Poinar et al. 2007). The amber dates back to the mid-Cretaceous (ca. 110–100 Ma) (Shi et al. 2012, Xing and Qui 2020) and is remarkable for its high abundance of arthropod inclusions, among them many families of Orthoptera (Ross 2024).

Elcanidae were organized into two subfamilies by Gorochov et al. (2006): the Elcaninae Handlirsch, 1906 and the Archelcaninae Gorochov, Jarzembowski & Coram, 2006. The main point of differentiation between the two is the state of the forewing veins 1A, CuPb and CuPaβ, which are fused in Elcaninae, but not in Archelcaninae (Gorochov et al. 2006). In the case of Elcanidae from Burmese amber (and for the entire family), the Elcaninae are more diverse than their sister taxon (Cigliano et al. 2025). So far, only four species of Archelcaninae are known from the amber but fourteen species of Elcaninae (Cigliano et al. 2025, Schall et al. 2025).

In this study, we describe two new species of Archelcaninae from Burmese amber.

Materials and methods

The taxonomy in this study follows the Orthoptera Species File (OSF) (Cigliano et al. 2025). Wing venation nomenclature follows Béthoux and Nel (2002). Abbreviations: CP = posterior costa; ScA, ScP = anterior/posterior subcosta; R = radius; RA, RP = anterior/posterior radius; MA, MP = anterior/posterior media; CuA, CuP = anterior/posterior cubitus; CuPaα = anterior branch of first posterior cubitus; CuPaβ = posterior branch of first posterior cubitus; CuPb = second posterior cubitus; 1A = anterior anal vein.

The specimens presented in this study are housed in the collection of the Leibniz Institute for the Analysis of Biodiversity Change (Hamburg) (GPIH07233 and GPIH07234). They were discovered at a mining site in Myanmar, either near Tanai village or Hkamti village. The age of the two amber sites differs by ca. 10 Ma. Amber from Tanai is estimated to be 98.79 ± 0.62 Ma old (Shi et al. 2012), and amber from Hkamti is ca. 110 Ma old

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(Xing and Qiu 2020). Tragically, political stability and the enforcement of human rights continue to be problematic in Myanmar. For a detailed discussion of the conflict and ethical problems surrounding amber fossils of Burmese origin, see Haug et al. (2020). Unfortunately, we do not know the year the amber pieces in this study were originally obtained (pre- or post-2017), but we argue that material already present in collections should not be ignored for scientific examination.

For imaging of the specimens, we used a DUN. Inc. stacking system with a Canon EOS 5Dsr Camera with a 65 mm lens and a magnification of 1× for GPIH07233 and 2× for GPIH07234. Individual pictures were taken with the VD Passport and Capture One program (Capture One A/S, Denmark) and stacked with Zerene Stacker (Zerene Systems LLC, Washington, USA). They were edited with the Photoshop CS6 Extended application by Adobe Inc. (USA; https://www.adobe.com). Further modifications (e.g., scale bars) and creation of image collections were done in Inkscape (v. 1.3.2) (the Inkscape Team, 2024). Drawings were created in GIMP (v. 2.10.38) (the GIMP Team 2025).

Systematic palaeontology

Order: Orthoptera Olivier, 1789
Superfamily: Elcanoidea Handlirsch, 1906
Family: Elcanidae Handlirsch, 1906
Subfamily: Archelcaninae Gorochov, Jarzembowski & Coram, 2006

Genus: *Parelcana* Handlirsch, 1906

Type species.—*Parelcana tenuis* Handlirsch, 1906.

Parelcana xena **sp. nov.**
https://zoobank.org/96AA6449-DF4B-4A15-92D5-A38E5E410234
Figs 1, 2

Etymology.—Xena derives from the ancient Greek word "ξένος" for "strange." It alludes to the unusual morphology of the type specimen's CuA + CuPaα, probably an individual aberration.

Locality and horizon.—The specimen was included in amber found in Hkamti, Sagaing Division, Myanmar or Tanai, Kachin State Burma, Myanmar, two nearby amber mining locations. The amber from Hkamti is ca. 110 Ma, and the amber from Tanai is ca. 99 Ma old.

Holotype.—Sex unknown. The specimen is part of the LIB-Hamburg collection, collection number GPIH07233 (ex coll. Martin Husemann MH0051) (Fig. 1). The amber piece containing the specimen has some syninclusions, including tiny beetles and fragments of larger unspecified invertebrates. It is relatively transparent. Measurements are 31.4 mm × 24 mm, and weight is 1.59 g. The amber is in good condition.

Diagnosis—Tegminal M with four branches. Stem of RP just posterior of second MA1 branch. RP with six to seven branches. RA with numerous comb-like cross veins. ScP with four secondary branches and ScA with two secondary branches. Two wing spots present, the anterior of which is distinctly larger than the posterior (Fig. 2A, B).

Description.—Preserved are the wings, the pro- and the mesothoracic leg. The rest of the body appears to have dissolved. Prothoracic leg. Femur 2.5 mm long, same as tibia. First tarsal segment 0.85 mm, second 0.07 mm, third 0.4 mm (not including claws). Femur dorsally with evenly spaced short hairs, ventrally and on the surface with finer and far more abundant hairs. Subapically with a cuspidal lobe. Tibia thinner than femur, with similar "hair pattern" as on femur, but dorsal hairs slightly more frequent and prominent, here interspersed with finer hairs. Apically with two large spines. First tarsal segment dorsally with short hairs. Third tarsal segment with two long claws (0.27 mm long); arolium absent. Mesothoracic leg. Tibia 2.6 mm. Femur approximately same length, but exact scale obscured by object in the amber. First tarsal segment 0.87 mm, second 0.17 mm, third (as preserved, with distal part/claws missing) 0.67 mm. Hair pattern of femur and tibia inversed to prothoracic leg (evenly spaced short hairs on ventral side of femur etc.). Femur without subapical cuspidal lobe. Tibia without long apical spines. First tarsal segment dorsally with short hairs. Apically with three claw-like spines. Second tarsal segment with cuspidal lobe bearing short hairs. Third tarsal segment with short hairs, more evenly spaced than on first tarsal segment and cuspidal lobe of second tarsal segment (Fig. 2C). Wings. The wings of the species show two dark wing spots, the anterior one being noticeably larger than the posterior one. Anterior wing spot 1.4 mm in diameter. Posterior wing spot 0.84 mm in diameter. The spots appear to be located on the hindwing. However, this cannot be said for certain due to the strong wing overlap (Fig. 2A). Forewing. Ca. 12.6 mm long (with most distal part reconstructed). CuPb and CuPaβ free. CuPaα fused with free CuA. M with four branches, all of them anterior to stem of RP. RP with six to seven branches. Pterostigma present, area with numerous cross veins (> 14). ScP with 5 branches. ScA and CP each with three branches (Fig. 2B).

Hindwing. Slightly shorter and of slightly less height than forewing. Venation pattern unsure because mostly overlapped by the forewing.

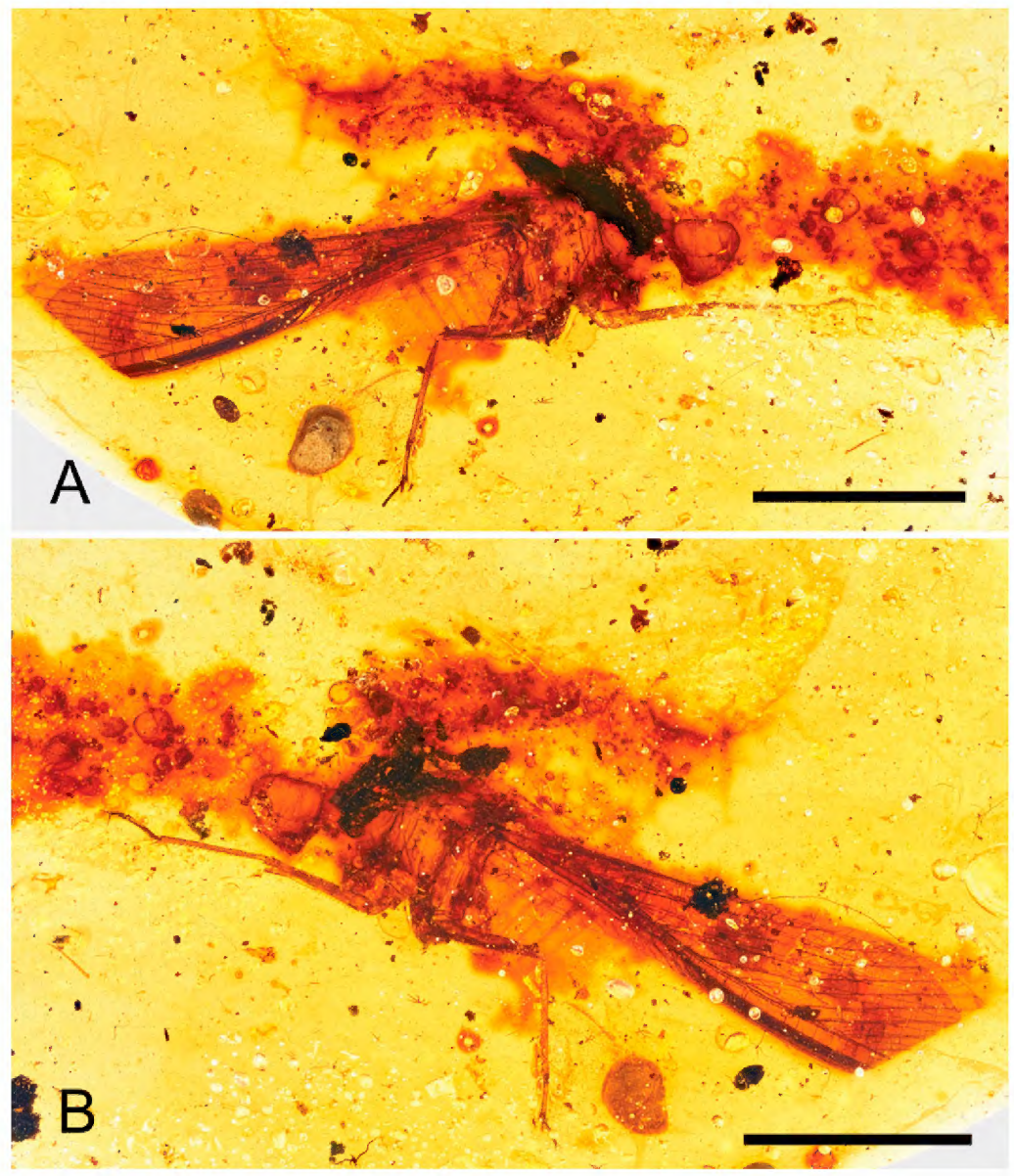


Fig. 1. *Parelcana xena* sp. nov. holotype (sex unknown) GPIH07233. **A.** Specimen (right side). **B.** Specimen (left side). Scale bars: 5 mm.

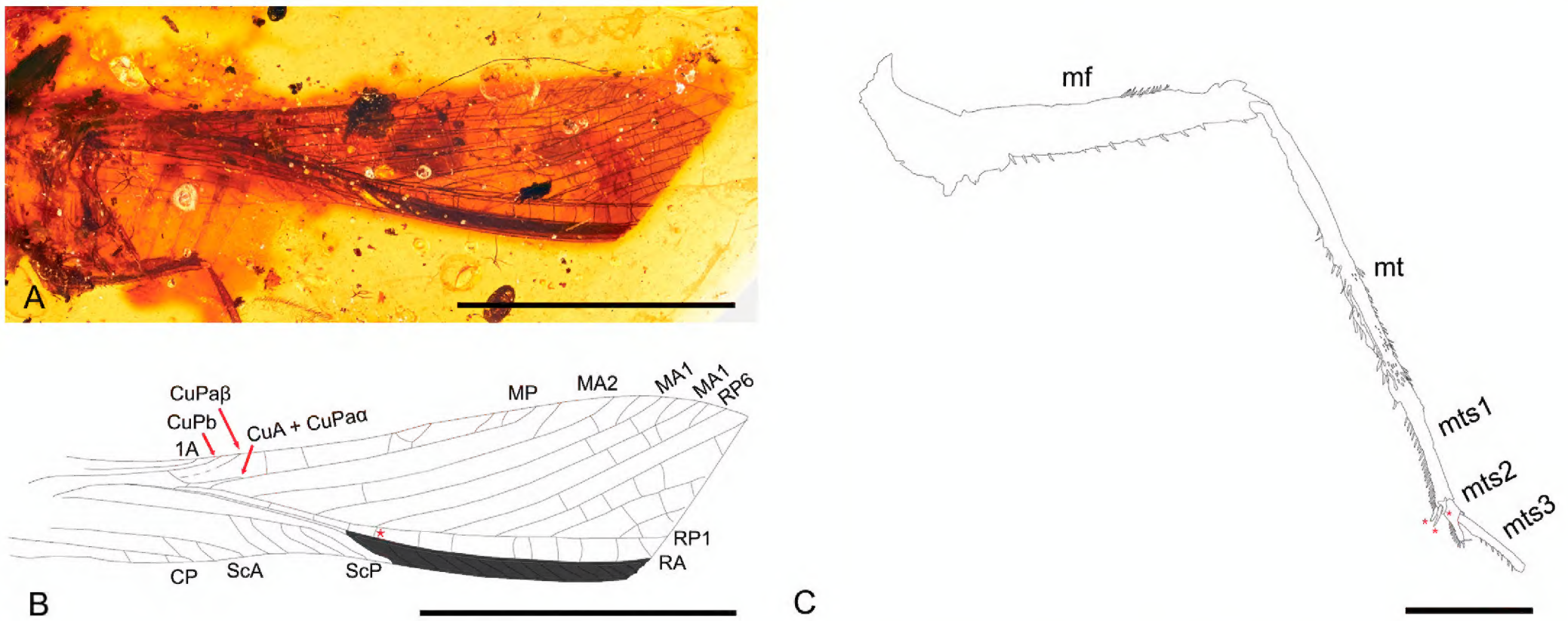


Fig. 2. *Parelcana xena* sp. nov. holotype (sex unknown) GPIH07233. **A.** Detail of wings (forewing overlapping the hindwing). **B.** Schematic drawing of the forewing. **C.** Line drawing of the mesothoracic leg. Abbreviations: mf = metafemur; mt = metatibia; mts1-3 = metatarsal segment 1-3. Scale bars: 5 mm (**A, B**); 1 mm (**C**).

Remarks.—The new specimen is attributed to the subfamily Archelcaninae based on the tegminal veins 1A, CuPb, and CuPaβ reaching the anterior wing margin independently. It is assigned to *Parelcana* because of its morphology of CuPaα fused with free CuA (Gu et al. 2020) and the very short, nearly vertical CuA (Tian et al. 2019). The four branches of M anterior of the RP stem clearly separate it from *Cascadelcana* Fang, Muscente, Heads, Wang & Xiao, 2018, where there are only two branches of M anterior of the RP stem. In *Parelcana*, there are usually three branches of M anterior of the RP stem; however, we think that the four branches in *P. xena* are likely due to intraspecific variation, especially because the RP stem is very close to the posterior MA1. The position of the RP stem in relation to the branches of M was proposed as an important diagnostic character by Gorochov et al. (2006). However, in rare instances where the intraspecific variability in Elcanidae was able to be analyzed (Zessin 1987, Tian et al. 2019), it was indicated that the RP stem may be somewhat variable in its position. For example, the RP stem was located posterior of the anterior MA1 in three specimens of *Parelcana pulchmacula*, but right below the anterior MA1 in a fourth specimen (CNU-ORT-NN2016042). Zessin (1987), who studied dozens of specimens of Jurassic Elcanidae from Germany, noted that "the proximal beginning of RP in relation to its position to MA1 [= MA2] is subject of considerable variation within the same species (*E. minima*) [now *Panorpidium minimum* (Handlirsch, 1906)] already" (translated from German). Indeed, this variation is clearly visible in several of the specimens depicted in Zessin (1987) in, for example, figs 23, 25.

The newly described holotype specimen of *P. xena* is characterized by CuA + CuPaα of the forewing very short and fused to MP, which is most unusual and not known from any described Elcanidae. It is likely that this morphology can be interpreted as another occurrence of individual aberration. In *Jeholecana yanensis* Fang, Heads, Wang, Zhang & Wang, 2018 from the Lower Cretaceous Yixian Formation of China, CuPaβ is fused to CuA + CuPaα in a similarly unique way. Fang et al. (2018) considered this as sufficient for generic separation, but Gu et al. (2020) found the same state in one of six specimens of *Calliptamus abbreviatus* Ikonnikov, 1913, stating that this strongly indicated individual variation.

Among its congeners, *Parelcana xena* shares similarities to the type species *P. tenuis*. Both species have six branches of RP, nearly the same number of ScP branches (four in *P. tenuis* and five in *P. xena*), and they are also of similar size (holotype (forewing) of *P. tenuis* ca. 14 mm long (Zessin, 1987); holotype (forewing) of *P. xena* ca. 12.6 mm long). Aside from the great temporal (ca. 80 Ma) and spatial (Germany vs. Myanmar) distance, *P. tenuis* differs from *P. xena* in the morphology of the anal veins, which are more numerous in *P. tenuis* (three longitudinal veins below 1A vs. none in *P. xena*). The new species differs from *P. pulchmacula* Tian, Gu, Yin & Ren, 2019 from the middle Jurassic of China by being smaller (holotype (forewing) of *P. pulchmacula* 18.4 mm long (Tian et al. 2019)) and having no color pattern of the wing aside from the two spots. Although the wing spots of *P. xena* may be located on the hindwings (which are not known for *P. pulchmacula*), the forewing of the Chinese species shows clear sings of the abstract color pattern present in many Jurassic elcanids such as *Archelcana numbergerae* Heads, Thuy & Tamarri, 2022. This abstract color pattern is not present in *P. xena*.

The taxonomy of *P. dubia* Handlirsch, 1939 and *P. anglicana* Handlirsch, 1939 is problematic. In *P. dubia*, important diagnostic characters for subfamily and generic diagnosis are missing. *Parelcana anglicana* may be closer to *Archelcana* Sharov, 1968 based on its CuPaα fused with CuA + CuPaα (Handlirsch 1939).

Genus *Longioculus* Poinar, Gorochov & Buckley, 2007

Type species.—*Longioculus burmensis* Poinar, Gorochov & Buckley, 2007

Longioculus poinari sp. nov.

https://zoobank.org/C8472E79-33F8-4DDC-8384-E382E1E098D7

Figs 3, 4

Etymology.—The species is named after George O. Poinar, who described the genus and first species of *Longioculus* and made many more contributions about prehistoric insects found in amber.

Locality and horizon.—The specimen was included in amber found in Hkamti, Sagaing Division, Myanmar or Tanai, Kachin State Burma, Myanmar, two nearby amber mining locations. The amber from Hkamti is ca. 110 Ma, and the amber from Tanai is ca. 99 Ma old.

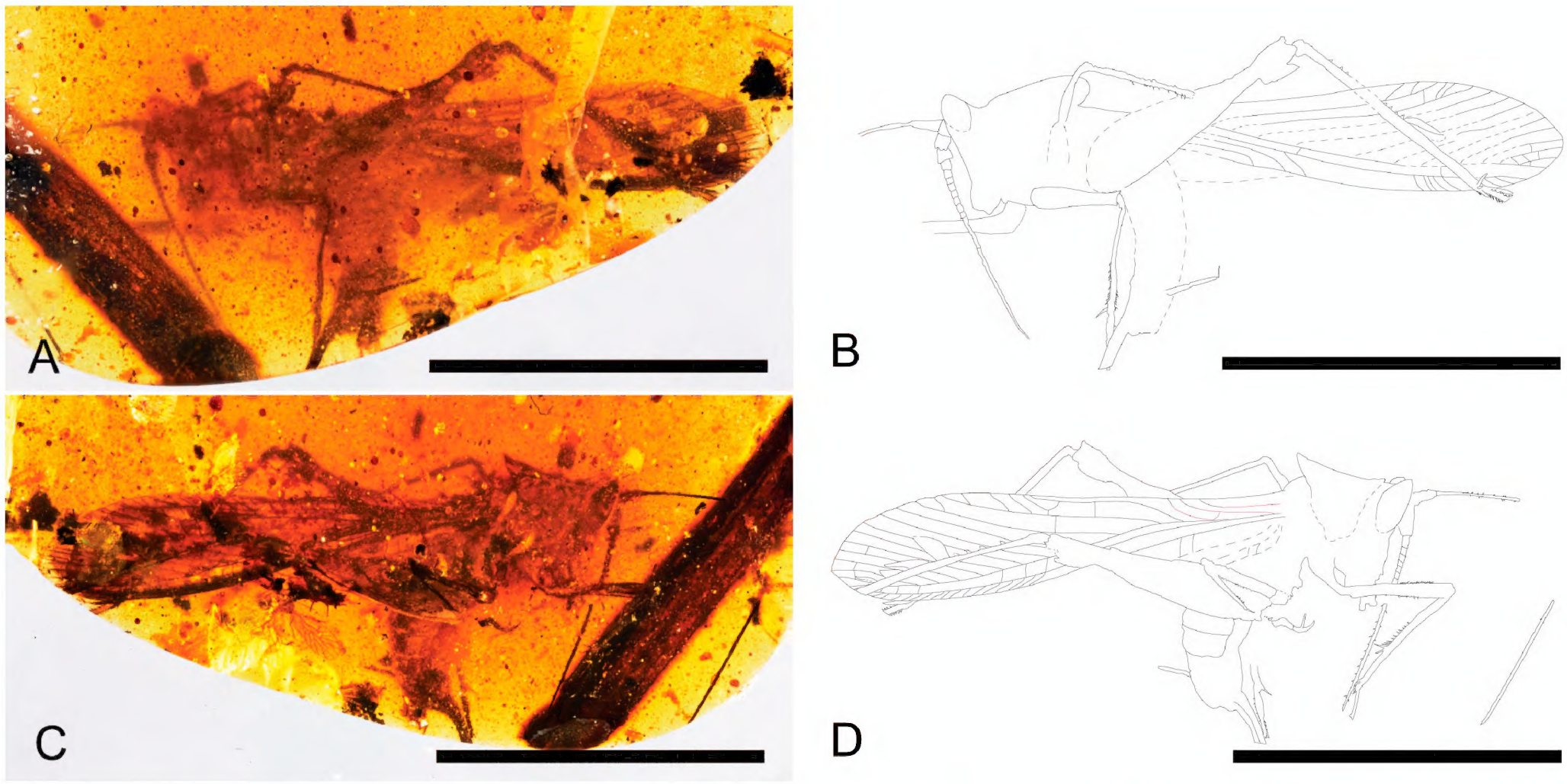


Fig. 3. *Longioculus poinari* sp. nov. holotype female GPIH07234. **A.** and **B.** Left side of specimen. **C.** and **D.** Right side specimen. Scale bars: 5 mm.

Holotype.—Female. Specimen part of the LIB-Hamburg collection; collection number GPIH07234 (ex. coll. Martin Husemann MH0065) (Fig. 3). Syninclusions include several insect fragments and insects covered by other objects. Among these are two dipterans, one of which belongs to Nematocera Latreille, 1825, and a well-preserved mite. Some trichoms are also included. The amber piece appears rather dark due to many particles clouding the interior. Its measurements are 13.7 mm × 10 mm, and it weighs 1.15 g. The piece is in overall good condition but has some fragments broken off on the opposite margin of the specimen and should be handled with care.

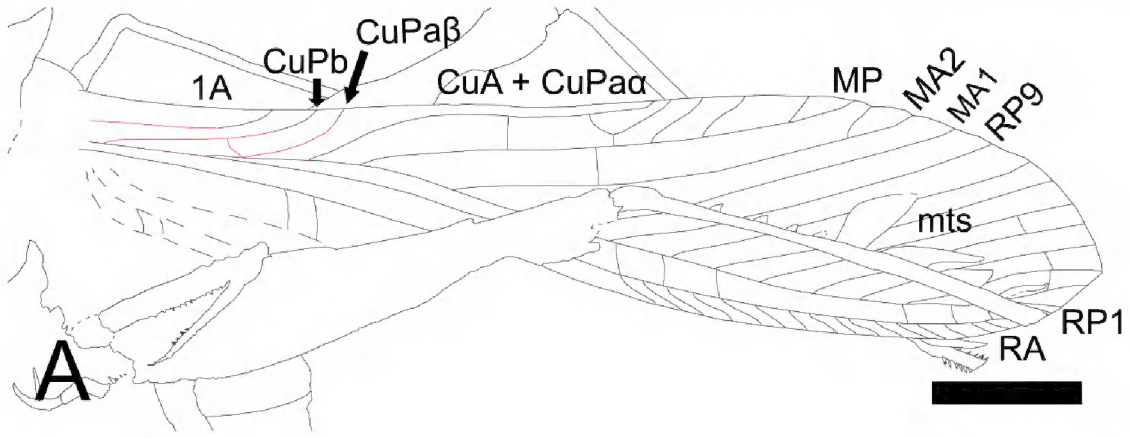
Diagnosis.—Forewing characters: 1A, CuPb, and CuPaβ free. CuPaα fused with CuA + CuPaα. M with three branches. RP with nine branches. RA with 16 or more cross veins. Body characters: Proximal part of metatibia dorsally with denticles the same height as metatibia. Metatibial spurs leaf-like. Apically with four spine-like spurs, one small, two medium, one large. Metabasitarsus dorsally with smaller, ventrally with longer spines; dorsally less numerous than or equally as much as ventrally. Ovipositor sword shaped (Fig. 4).

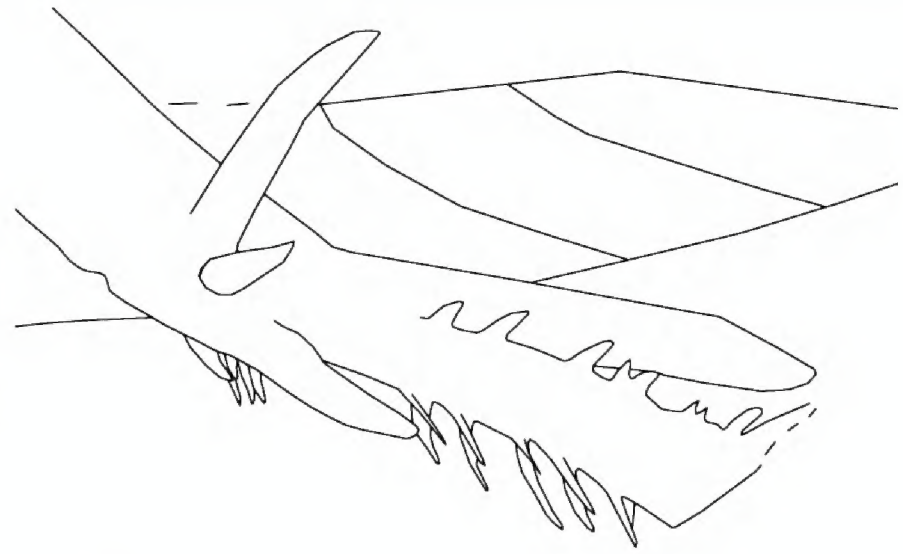
Description.—Completely preserved specimen with only parts of the antennae and ovipositor missing. Body length ca. 5.2–5.5 mm. Wings. Forewing 6.9 mm long. 1A, CuPb, and CuPaβ free. CuPaα fused with CuA + CuPaα. MP with regularly spaced cross veins, one of them Y-shaped. M with three branches. RP with nine branches, no terminal bifurcation of any RP branch. Pterostigma present. Pterostigma area with cross veins (> 16). Subcostal venation not visible. Hindwing 6.64 mm long (Fig. 4A). Head. Antennal scapes large, same width as antennal cavities. Antennomeres with small spines, irregularly placed. Eyes strongly protruding, oval shaped, and much higher than wide. Eyes 0.94 mm high (ca. half of head height) (Fig. 4C). Thorax. Pronotum 1.4 mm long (dorsally), elevated from thorax (Fig. 4C). Prothoracic leg: Femur 1.6 mm long. Dense short hairs dorsally, few fine denticles/short hairs ventrally. Tibia ca. 1.4 mm long. Ventral spination starting at ca. half the length and increasing in size toward apex. Two apical large spines at a V-angle. Tarsus three-segmented. First tarsus looking like continuation of tibia, but without spines, except one or two large apical spines (perhaps again at V-angle). Second tarsal segment much shorter than first, bearing a lobe. Third tarsal segment ca. 70% of first tarsal segment in length, slender. Claws missing (Fig. 4C).

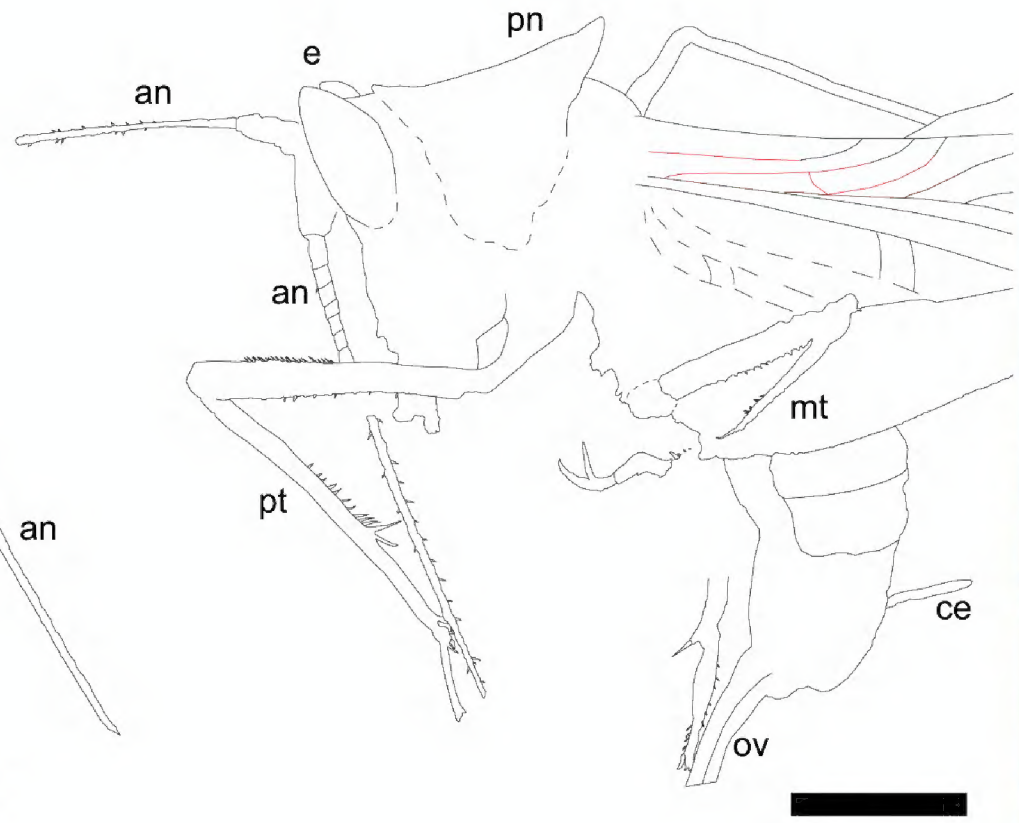
Mesothoracic leg: With some damage. Small spines present on femur and tibia. At least one large spine apically on tibia. Tarsus with hairs and two claws (Fig. 4C). Metathoracic leg: Femur 3.56 mm long, 0.76 mm high. Tibia 3.51 mm long, much thinner than femur. Proximally with small denticles. Metatibial spurs leaf-like. Apical spurs spine-like, two small, two medium and one large one. Only basitarsus preserved (cut off at amber). Dorsally with smaller, ventrally with longer spines (Fig. 4A–D).

Abdomen. One cercus preserved, straight, 0.78 mm long. A single hair near the cercus tip might be a detached appendage of the tip; however, no appendage was present in the holotype. Ovipositor broken off shortly after base, but apparently sword-shaped (general direction does not indicate a scythe-like curve) (Fig. 4C).

Remarks.—The new species is placed in the subfamily Archelcaninae based on its free 1A, CuPb, and CuPaβ. It is attributed to the genus *Longioculus* based on the large protruding eyes, which are much higher than wide, RA with visible cross veins, the absence of wing spots, postero–lateral margin of pronotum without concave curve, and metatarsus with denticles and cerci not setulose. A detailed comparison of the known species of Archelcaninae from Kachin amber is provided in Table 1. The state of 1A, CuPb, and CuPaβ is unknown in *L. burmensis*, but the genus can be assigned to the Archelcaninae based on the free state of these veins in the new species.







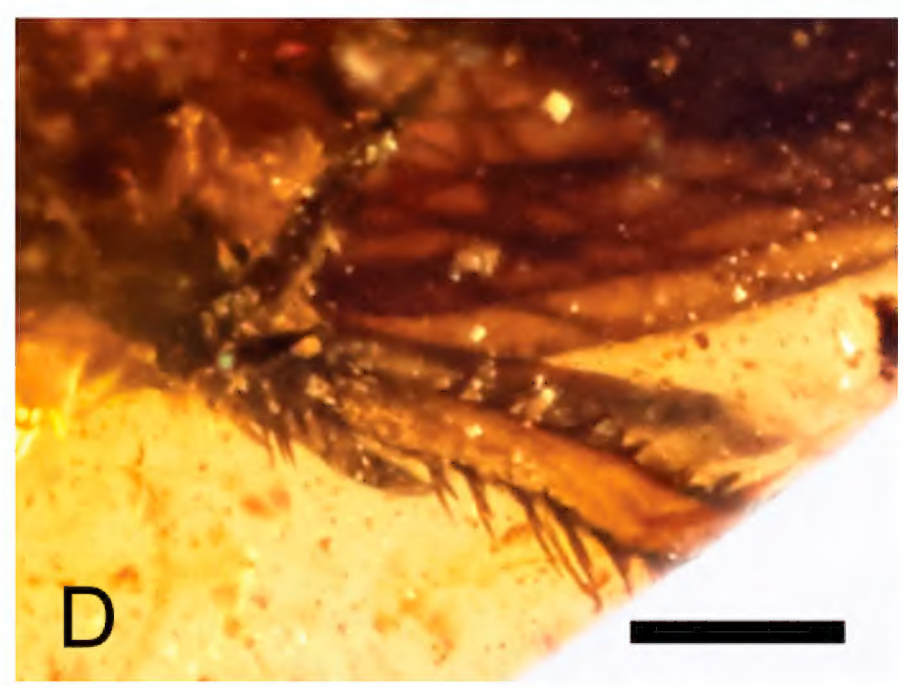


Fig. 4. *Longioculus poinari* sp. nov. holotype female GPIH07234. **A.** Schematic drawing of the forewing. **B.** Schematic drawing of the apical spines on the metatibia and metabasitarsus. **C.** Schematic drawing of the body aspects. **Abbreviations:** an = antenna; pt = prothoracic leg; e = eye; pn = pronotum; ov = ovipositor; mt = mesothoracic leg; ce = cercus. **D.** Apical spines on the metatibia and metabasitarsus. Scale bars: 1 mm (**A, C**); 0.2 mm (**B, D**).

Table 1. Comparison of *Longioculus poinari* sp. nov. with other members of the Archelcaninae Gorochov, Jarzembowski & Coram, 2006 from Kachin amber.

Species	Compound eyes strongly protruding above head	RA with visible cross veins	Presence of wing spots	Postero–lateral margin of pronotum with concave curve	Metatarsus with denticles	Branches of RP	Branches of M anterior of RP stem	Cercus setulose	CuPaα fused with…
Longioculus poinari sp. nov. described herein	Yes	Yes	No	No	Yes	Nine	Three	No	CuA + CuPaα
Longioculus burmensis Poinar, Gorochov & Buckley, 2007	Yes	Yes	No	No	Yes	NN	NN	No	NN
Caelielca spinocrus Uchida, 2022	No	Yes	No	Yes	Yes	Eight	NN	Yes	CuA + CuPaα
Hukawnelca gracile Uchida, 2022	No	Yes	Yes	Yes	Yes	Six	NN	Yes	CuA + CuPaα
Thagyaminana atawedeia Schall, Kotthoff & Husemann, in press	NN	No	Yes	Yes	NN	Ten	Three	No	CuA + CuPaα
Parelcana xena sp. nov., described herein	NN	Yes	Yes	NN	NN	Six	Four	No	Free CuA

Poinar et al. (2007) described the forewing of *L. burmensis* with a stem of RP (orig. "base of RS") between the third and fourth branch of RP ("RA") (RP branches counted in the direction towards wing apex). In *L. poinari*, the position of the stem of RP is unsure; however, it is not further posterior than behind the ninth branch of RP as the area of the wing from there can be well seen. We estimate that the stem of RP in *L. poinari* is either be between MA1 and RP9 or RP9 and RP8. This position is much more in line

with where the stem of RP can usually be found in the forewings of Elcanidae. It would be helpful if the type specimen of *L. burmensis* could be reviewed to confirm the position of the RP-stem in this species. Unfortunately, its whereabouts in the collection of R. Buckley are currently unknown.

Longioculus poinari differs from *L. burmensis* by not having seven circular light blotches on the dorsal surface of the pronotum and by the denticles on the proximal half of the metatibia being broader and more prominent.

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